
Academic health sciences library Website navigation: an analysis of forty-one Websites and their navigation tools

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Background: The analysis included forty-one academic health sciences library (HSL) Websites as captured in the first two weeks of January 2001. Home pages and persistent navigational tools (PNTs) were analyzed for layout, technology, and links, and other general site metrics were taken.

Methods: Websites were selected based on rank in the National Network of Libraries of Medicine, with regional and resource libraries given preference on the basis that these libraries are recognized as leaders in their regions and would be the most reasonable source of standards for best practice. A three-page evaluation tool was developed based on previous similar studies. All forty-one sites were evaluated in four specific areas: library general information, Website aids and tools, library services, and electronic resources. Metrics taken for electronic resources included orientation of bibliographic databases alphabetically by title or by subject area and with links to specifically named databases.

Results: Based on the results, a formula for determining obligatory links was developed, listing items that should appear on all academic HSL Web home pages and PNTs.

Conclusions: These obligatory links demonstrate a series of best practices that may be followed in the design and construction of academic HSL Websites.

INTRODUCTION

Almost as soon as Mosaic, the world's first Web browser, was released in 1993, academic health sciences libraries (HSLs) began developing Websites. In 1994, a small and unscientific list of medical library Websites compiled on MEDLIB-L revealed that approximately thirteen university medical libraries had some kind of Web presence [1]. Within the next few years, most academic HSLs developed their own Websites.

The development of these Websites has proceeded at such a pace that it is now almost inconceivable for an academic HSL not to have a Web presence of some kind. While standards for accessibility and usability have often been followed in developing these Websites, for the most part, academic HSL Websites continue to be designed in a vacuum. Each Website is a unique construction, designed to meet the needs of the community of users served by its respective library.

However, users of academic HSLs share many common traits, backgrounds, and interests, and the way in which college and university faculty, staff, and students use libraries does not differ dramatically from institution to institution. Furthermore, it is not an uncommon practice for those users to access library Websites from institutions other than their own to find information. With that in mind, one might expect to find the same types of links to information and resources on any given academic HSL Website or at least for links to be organized in a similar manner from site to site. The user's ability to navigate these Websites fluidly may have an impact on important research and education activities.

If the missions of academic HSLs are similar, it stands to reason that their Websites also share common traits, including home page and navigational links to content and resources. By analyzing these links from a sampling of academic HSL Websites, a series of standard practices can be cataloged. To this

end, an analysis of forty-one academic HSL Websites was conducted to discover trends in the navigational links and to recommend practices for designing Website navigational systems.

LITERATURE REVIEW

Navigation, in whatever form, is necessary and expected on an academic HSL Website. It provides cues and assistance in guiding users to the information they require. While online help for specific library resources and catalogs is nothing new [2], an examination of navigation on academic HSL Websites has not been covered in any considerable depth in the library literature. However, some research regarding the architecture of academic and other library Websites has been published, and a few of these articles discuss specific concepts that affect this study.

Stover and Zink wrote one of the first major articles to examine academic library Websites in depth [3]. While not addressing navigation specifically, they did push the need for "information cues" that would give the user a sense of orientation and direction. The article also commented on the need for notes that would guide Website visitors in their use of particular resources, most specifically the online catalog.

The article by Stover and Zink also analyzed library home pages for the number of links provided, stating that an appropriate number of links for a home page should fall between three and nine. While this number might have been appropriate in 1996, it seems uncomfortably low for libraries today.

Broader-scoped comparisons, such as King's analysis of home pages for member libraries of the Association of Research Libraries (ARL) [4], followed. King found that the average number of links on an ARL library home page was 21.6, and that 37% of the libraries he surveyed had between 10 and 19 links on their home pages. But the specifics of what pages and resources were being linked were not discussed in the article.

Riddle conducted another comparison, this time of university main pages, not specifically libraries [5]. Riddle found that in a survey of twenty-two major university pages, search forms were included on only seven sites and site maps on eight.

Brinkley listed four primary functions for a library Website: promotion, information about services, guides and help facilities, and gateways to information resources [6]. Brinkley went on to stress a facilitated, subject-oriented navigational structure for library resources. The author also emphasized the need for integrated help functionality throughout a library Website, especially in the form of context-sensitive help pages.

A paper by Cohen and Still offered a fairly detailed analysis of Websites of research university libraries and 2-year college libraries [7]. The authors analyzed 100 Websites for specific kinds of resources and information and noted some links from the home page, although they did not analyze other forms of navigation.

Categories of surveyed resources included general library information, reference, research, instruction, and functionalities such as search or Web-based forms. Their conclusions listed a series of elements that they considered core to any academic Website. Many of these elements were links to specific resources, including the library's online public access catalog (OPAC), Internet subject guides, search engines, subscription databases, and electronic journal services.

Bao reported findings from a survey of 143 academic library home pages, primarily examining the location of links to the library home page from the home page of its parent institution [8]. The article noted, however, that 76% of the surveyed libraries provided links to commercial online databases on their home pages.

BACKGROUND

To examine the navigational elements of a large Website, such as those of an academic HSL, the structures that contain those elements needed to be defined. For the purposes of this study, two major structures were defined and analyzed for their links: the home page and the persistent navigation tool (PNT).

A home page is defined as a complete Web page that serves as the primary entry point for a library's Website. As a bridge into a Website, the home page serves several functions, including establishing a site's identity and purpose, providing promotional or time-specific content, offering shortcuts for advanced users, and essentially providing all users with a place to begin their work. For an academic HSL Website, the home page might include links to guides or tutorials designed to assist the beginning researcher alongside "quick links" or links directly to a library's most frequently accessed resources.

A PNT is defined as a series of links that are consistent in appearance and function from page to page in the site with the clear function of linking to the primary information and service areas of the site. It gives the user a path to the functions and content of a Website that is always located in the same space on each Web page, it offers the same links consistently, and its appearance does not significantly change.

A simple link back to the home page from successive pages does not qualify, in and of itself, as a PNT. For this study, additional navigational options need to accompany the home page link for it to qualify as a PNT.

Sometimes secondary and tertiary navigation in subsections of a larger Website can be confused with persistent navigation. Secondary or tertiary navigation allows a user to find more granular forms of content in information-dense areas of a larger site. For example, if a user clicks on a home page link to "Library Departments" and is then given a list of links to pages about those departments, that would be a secondary navigation structure. It would appear on that one page and would lead the user deeper into the Website.

But the links on a PNT are specifically designed not

to change with the content of the site, they are "global" links, consistent wherever the user happens to be while navigating a large site. Secondary or tertiary navigation tools are not included in this analysis of PNTs.

Although the PNT is discussed in terms of being a "tool," it is instead a navigational structure that is duplicated on every page. Therefore, even if toolbars exist on the top, left side, and bottom of a Web page, so long as they are duplicated on every page of the site, they are referred to collectively as the PNT.

METHODS

To examine academic HSL Websites as static constructs, it was necessary to create a local mirror of these Websites. All academic HSL Websites used in the sample were copied to a locally available server. These copies were then examined over a lengthier period of time without concern about new content being added or significant changes being made to the navigation.

One hundred and nineteen academic health sciences and medical library Websites were copied over a period of 24 days, beginning December 26, 2000, and ending January 18, 2001. To expedite downloading and archiving of these sites, a Web spider was selected. Web spiders are simple Internet "robots" that can be programmed to create local copies of existing Websites by following all links in a given domain and downloading all hypertext markup language (HTML) files, graphics, and attached files. This process is referred to as "spidering." The Teleport Pro version 1.29 from Tennyson Maxwell Information Systems Web spider was selected for its extensive features and ease of use.

The spider's parameters were set to download all relevant files at all levels in the original domain and path of the library's Website, excluding some larger files such as programs (.EXE files) and compressed archives (.ZIP) that would have minimal impact on the project. The spider also was not allowed to move backward in the domain. In other words, if the original uniform resource locator (URL) for the library's pages were <http://www.university.edu/library/>, the spider would not be able to move back to <http://www.university.edu> to get files for other facilities in the larger organization. Only library pages were copied.

No password-protected files or files accessible only from specific Internet protocol (IP) address ranges were spidered. This procedure excluded all but publicly available content on each library Website.

Of the 119 Websites spidered, a selection of 41 was then evaluated. These Websites were selected based on rank in the National Network of Libraries of Medicine (NN/LM), with regional and resource libraries given preference. Of those sites selected, a conscious effort was made to select nearly equal numbers of publicly and privately funded institutions and to select sites from each of the 7 NN/LM regions. None of the selected Websites were viewed prior to evaluation.

It should be noted that this selection was comprised

mostly of NN/LM regional and resource libraries, because these libraries are recognized as leaders in their regions and would be the most reasonable source of standards for best practice. While not a purely random sampling, the selection of forty-one was a geographically diverse, mixed grouping of public and private academic libraries that were highly ranked in their NN/LM regions. It could be assumed that these libraries created their Websites with some degree of deliberation and concern for usability and accessibility. Identifying the standards of practice of the leading NN/LM academic HSLs should mean identifying best practices for all academic HSLs.

These forty-one locally copied and static Websites were then evaluated by hand, using an evaluation form and checklist. The evaluation form was developed based on similar elements noted in the previously mentioned studies by King, Bao, Stover and Zink, and especially Cohen and Still. The form was augmented with informal feedback from other librarians and with other elements of particular interest to the author.

When considering the vast and complex variety of services and resources available to libraries, a comprehensive list of all possible links was not a viable option. Instead, in creating the evaluation form, the author endeavored to create a robust list that would demonstrate the breadth of possible navigational choices without being overwhelmed by options during the evaluation process.

The evaluation form breaks down into the following categories:

- technologies and form of any or all navigational constructs
- layout of the PNT, if one is present
- links from the home page and from the PNT, if one is present
 - library general information
 - library Website aids and tools
 - library Web-based services
 - library Web-based resources
- navigational metrics

The items in these categories were then marked whenever a specific element in that category was present. The majority of these elements were links, whether from the home page or the PNT. All links had to take the user directly to the subject, resource, or service listed in the evaluation form. Labeling was not an issue for these links, so long as the item linked was correct. If a link was labeled "Online Journals" and linked to a series of electronic journal titles, then it was marked in the evaluation form as "E-journals."

If a second link was required to get to the specified information in the evaluation form, then the link was not counted in the evaluation. An example might be a home page with a link to "Resources," which in turn linked to "E-journals." In this example, a mark for e-journals in the library Web-based resources section of the evaluation form would not be warranted or appropriate, as the home page did not link directly to that resource.

Submenus, where an item on a home page spawns

a series of related links, counted only as a single click. So, if in the example above, "Resources" was a home page item that spawned a submenu that included "E-journals," then the link was counted in the evaluation.

Along with a mark for the existence of a particular element, some relatively simple calculations were conducted for navigational metrics, which asked for the total number of links from both the home page and the PNT. This calculation looked for all elements on the home page that were "clickable": that is, any element that, once clicked, would take the user someplace else. If the PNT was duplicated on the home page, these numbers would be counted in the home page tally as well.

RESULTS

Technologies and form of any or all navigational constructs and layout of persistent navigation tool (PNT)

The analysis began with a look at the overall nature of the navigational elements available on the Websites. This first section examines whether a PNT is present, the layout of such a tool if present, and the technologies behind the navigational elements on the library's home page.

Of the 41 libraries examined, 35 (85%) had some form of PNT. Of those sites using PNTs, 60% used a horizontal toolbar exclusively, while 34% used both a horizontal and a vertical toolbar. Only 6% used a vertical toolbar exclusively, and no sites used toolbars that were neither horizontal nor vertical in orientation.

The analysis also examined various forms of Web technologies common to navigation tools. Several sites used more than one of these technologies. Fourteen sites (34%) employed rollover or image swap effects with their graphics. This technique switches one graphic for another as the cursor rolls over the link.

Eleven of the library Websites (26%) utilized pull-down menus. Pull-down menus allow a Web developer to include several links in the space of just one.

Frames seemed to have fallen out of favor, as have submenus. Only two analyzed library Websites used frames (5%), and two others used submenus. Image maps were used on only eight sites (20%).

Finally, most of the academic HSL Websites (41%) used no supplemental technologies at all, relying instead on standard HTML and graphics.

Links from home page and from PNT

Library general information. Links to general information about the library were examined, both from the home page and from any persistent navigation tool (Table 1).

The most common link of all was to a parent organization. In the case of academic HSLs, this link was often to the college or university main page. Thirty-eight home pages, accounting for 93% of the sites, linked to the parent organization, with 19 of those (46%) also including a link from the PNT.

Table 1

Percentage of libraries with links from home page and/or persistent navigation tool (PNT): library general information

Type of link	% home	% PNT
Departments	22.0	4.9
Directions or map to building	48.8	4.9
Hours of operation	68.3	12.2
Instruction or tutorials	80.5	26.9
Link to parent library or libraries	46.4	17.1
Link to parent organization*	92.7	46.4
Map of building	14.7	—
News, events, or "What's New"	80.5	19.6
Policies or procedures	17.1	2.5
Purpose or mission statement	14.7	2.5
Services, descriptions of	68.3	29.3
Staff directory	44.0	2.5
Virtual tour	17.1	2.5

* Indicates item was linked by majority of home pages and ratio of PNT links to home page links was greater than 50%.

Parent library links were also tracked, with 46% of the academic HSL home pages linking out to a general library home page and 17% of those home pages also linking to the parent library from PNTs.

The most prevalent home page links to library-specific information included links to library news or "What's New" features (80%), library education services including tutorials or class schedules (80%), library hours (68%), descriptions of library services (68%), directions or maps to the library (48%), and staff directories (43%).

These services, however, were frequently not linked from the navigation tool. Twenty-nine percent of sites (12) linked to descriptions of services from PNTs, and 27% (11) linked to library education services, but no other library general information link ranked higher than 20%.

Library Website aids and tools. Generally defined as any kind of link or tool that helped users make better use of the library Website, this section of the analysis looked for five specific kinds of links (Table 2).

The first of these help pages simply indicated a link to any tool or service the library identified as "help" or similar. Most often this would take the form of frequently asked questions or assistance in using the library and its services. Thirty-four percent of library home pages linked to some form of help, with 26% offering help from every page through the PNT.

Another kind of Website aid is the feedback form. Usually directed at the Web editors for the site, this kind of form enables any visitor to offer criticisms, suggest changes, or notify personnel of dead links. An overwhelming 88% of all library Websites had a link to a feedback form on their home pages, while 54% included a link from their PNT as well. None of the examined sites linked from the PNT without also including a link from the home page.

Two other Website aids were examined in tandem. While their approaches are slightly different, site indexes and site maps aid users in similar ways. A site index lists all significant terms associated with specific

Table 2

Percentage of libraries with links from home page and/or PNT: library Website aids and tools

Type of link	% home	% PNT
Help page(s)	34.2	26.9
Library Website feedback form or email link*	87.9	53.7
Library Website index	44.0	34.2
Library Website search*	75.7	61.0
Text-only version	9.8	2.5

* Indicates item was linked by majority of home pages and ratio of PNT links to home page links was greater than 50%.

pages on a Website, much as a book index lists all the significant passages of a book, usually in alphabetical order. According to Nielsen, a site map's main benefit is to give users an overview of the site's areas in a single glance by dedicating an entire page to a visualization of the information architecture [9]. Links to either a site index, site map, or both occurred on 44% of home pages and 34% of the PNTs of the surveyed libraries.

Another common tool for aiding users in finding information on a Website is the search engine. Nielsen has commented that users often rely on a search engine as their main hunting strategy, above and beyond any navigational elements [10]. Fortunately, site search tools have become commonplace, with nearly 76% of surveyed Websites having either a search form or a link to one on their home pages. Sixty-one percent included a link on their PNT as well.

Finally, the evaluation included links to text-only versions of the library Websites. Few library Webs offered such a link, with only 10% of all home pages having text-only counterparts and just 3% of the libraries having PNTs linking to text-only versions.

Library services. Electronic counterparts to more traditional library services often provide useful alternatives for remote users (Table 3). Electronic forms for document delivery and reference services provide users with unique and worthwhile services via the Web that they might not find elsewhere without significant cost.

A general Web page linking to library forms was the first such service tool to be analyzed. Sixty-three percent of the surveyed library Websites included a link

to such a page from their home page, but only 27% had such a link on their PNTs.

The analysis included two services directly related to library reference. Some form of electronic reference, often titled "Ask A Librarian" or something similar, was found on 46% of library home pages and 17% of their PNTs. This service included any form of email or live chat reference tools. Forms for requesting bibliographic searches appeared on 22% of HLS home pages, with only 2% including such a link from the PNT.

Several services related to document delivery or access services were also examined individually. The most popular of these, a form to request an interlibrary loan, was found on 59% of the library home pages and 10% of the PNTs. Links to photocopy request forms occurred on 37% of analyzed home pages and on 7% of all PNTs.

Finally, the analysis looked for occurrences of a link for contacting the Web designer or committee responsible for the site. Seventy-three percent of all library home pages included such a link, with an equally impressive 49% including such a link on every page via the PNT. This link differs from the feedback form in that it specifies a contact by name or a committee responsible for the Website. While a feedback form may be used to make comments about the Website or library in general, this link is intended to be used to contact the Web editor or similar authority for the site.

Library resources. The final section of the analysis was also the largest, examining all the various resources to which library Websites link (Table 4).

Some library sites collected the most frequently used resources into a single tool, often called "quick

Table 3

Percentage of libraries with links from home page and/or PNT: library Web-based services

Type of link	% home	% PNT
"Forms" page link	63.5	26.9
Contact reference librarian or "Ask a Librarian"	46.4	17.1
Contact Web editor or committee*	73.2	48.8
Hold a book	9.8	—
Renew materials	12.2	—
Request a book	24.4	—
Request a photocopy	36.6	7.4
Request a search	22.0	2.5
Request an interlibrary loan (ILL)	58.6	9.8

* Indicates item was linked by majority of home pages and ratio of PNT links to home page links was greater than 50%.

Table 4

Percentage of libraries with links from home page and/or PNT: library Web-based resources

Type of link	% home	% PNT
"Quick links," most requested, or most popular	22.0	4.9
Bibliographic databases, listed by subject	24.4	9.8
Bibliographic databases, listed by title	70.8	29.3
Bibliographic databases, direct link to any specified by name*	70.8	36.6
E-books	51.3	12.2
E-journals	85.4	29.3
General Internet search engines or directories	26.9	9.8
General subject-oriented directories or "Pathfinders"	17.1	7.4
Library online public access catalog (OPAC)*	95.2	58.6
Library-selected Internet resources	53.7	22.0
Local information (city, state)	7.4	2.5
Other libraries' OPACs	29.3	17.1
Other reference resources, including style guides, dictionaries, directories, encyclopedias, etc.	19.6	7.4

* Indicates item was linked by majority of home pages and ratio of PNT links to home page links was greater than 50%.

links" or some variation thereof. "Quick links" appeared in some form on 22% of the analyzed home pages and on 5% of the PNTs, suggesting that while this practice was not uncommon, it was applied infrequently.

Examinations of specific resources followed. Databases, most frequently bibliographic in nature, formed a significant part of library resources, sometimes organized by subject, arranged in an alphabetical list, or linked to individually by name. Links to subject-oriented lists of databases existed on 24% of the library home pages, while 10% included them on the PNTs. Lists of databases by title were more common, with 71% including links on home pages and 29% on PNTs. But links to specific databases, by their names instead of through lists, occurred exactly as frequently on home pages (71%) and more frequently on PNTs. Thirty-seven percent of the libraries included a link on their PNTs to at least one specific database by name.

Fifty-one percent of libraries linked to electronic books from their home pages and 12% from their PNTs. By contrast, 85% linked to electronic journals from home pages and 29% from PNTs. Lists of selected Internet resources, often organized by subject, were linked from 54% of the home pages, while 22% linked to such resources from PNTs.

The library catalog was linked from 95% of all examined home pages. However, only 59% included a link from a PNT. Links to the online catalogs for other libraries occurred on 29% of the home pages, with 17% linking from the PNTs.

Navigational metrics

An average number of 55.3 links were found on home pages, with a median number of 41 and a mode of 66. Some home pages had especially high numbers of links. Three libraries had more than 100 links on their home page, with the highest of these having 208 links total. PNTs had lower numbers of links, averaging 19.2 overall (14 median, 11 mode).

Pull-down menus contributed in part to link-dense home pages. Two of the 3 libraries with more than 100 links used pull-down menus. Eight of the 11 sites us-

ing pull-down menus fell above the median number of home page links.

Ratios comparing home page link tallies to those of PNTs produced some interesting results, but no overall pattern was detected. The ratios for the 3 libraries with more than 100 home page links were low, with comparatively small numbers for their navigation tools. With such high numbers of home page links, this ratio was not surprising.

Likewise, the ratios for those home pages with the lowest number of links were very high. One library with the lowest number of links overall—only 14 from the home page—duplicated this number of links exactly in their navigation tool. But with so few links available from the home page, it would make sense to duplicate them in the PNT.

DISCUSSION

When looking over the tallies from the analysis of these Websites, there is a tendency to look at the biggest percentages first. After all, as an example, if a strong majority of leading academic HSLs link to a Website search tool from their PNT, then that would be a measure that other libraries might want to emulate. But anyone looking at these results should also bear in mind the possibility that some libraries might not have the technical support necessary to offer a site search tool. It should be kept in mind that this analysis looked to discover whether a particular kind of link was present, not whether the library possessed a particular resource or service to which the home page or PNT might link. Also, the use of these links, which links were most often clicked by the library's users, was not a part of this study.

Care should be taken to consider the smaller numbers as well; some of the elements that did not occur as often might have value. An example of this might be a mission statement, an element that only 14.7% of evaluated home pages linked to. Perhaps this kind of information was typically found deeper in the site, but many libraries would provide a home page link, if

they felt that the information would be of interest to their user bases.

This analysis consists of information about Web pages captured in 2001, and it stands to reason that not all of these findings will have the same relevance today. An analysis of a representative sampling of the same academic HSL Websites in April 2004 shows a dramatic upswing in the number of links that appear on home pages and in PNTs, for example. Home pages in 2004 average 70.5 links, compared with 55.3 links in 2001. PNTs in 2004 average 38.2 links, compared with 19.2 in 2001. Simple observation also indicates that rollover effects and pull-down menus are more frequently used, and almost all (90%) academic HSL home pages now include address and telephone information.

However, with academic HSL Websites now having significantly higher numbers of links overall, it becomes harder to identify specific elements that should be ruled as obligatory or best practice. Additionally, the central issues of library Web design—accessibility, usability, content, and navigation—are fundamentally unchanged from 2001 to present day. The 2001 data set is not so old as to be obsolete, nor is it so large as to defy careful analysis. The recommendations that come out of this analysis still have validity for today's Web designers, and future analyses based on this study would certainly be welcome.

On the whole, the analysis of home page links from the original 2001 data set offers few surprises. Numbers of links to general information, Website aids, and resources are all respectable. Some specific types of links that are low in number can be reasonably explained. Policies and procedures, planning documents, and maps of library buildings most typically would be found deeper in the site and rarely warrant a top-level link.

Some library Web-based services generally are not linked from the home page as frequently as other categories. Renewing materials and placing holds on books, in particular, are not linked with any great frequency. A strong majority of sites include a link to a "forms" page, which might list such services alongside interlibrary loan and bibliographic-search request forms. The overall popularity of forms pages suggests that, when these services are available, they would be listed on the forms page.

The examination of links to library resources offers several items worthy of comment. One clear standout is the high number of links to either an alphabetical list of databases or specific databases by name. The relatively low number of links to subject-oriented lists of databases indicates that the other two methods are more popular by a significant margin.

These numbers suggest that academic HSLs anticipate that their user bases are already familiar with specific databases and know these databases by name. MEDLINE, for example, is undoubtedly known to the majority of their patrons. This practice, however, also suggests that academic HSLs anticipate that their users are as familiar with such databases as the Cumulative

Index to Nursing and Allied Health Literature (CINAHL), Biological Abstracts, EMBASE, and others as they are with MEDLINE. It is also possible that the interdisciplinary nature of the health sciences makes it difficult to organize these databases by subject, but this reasoning seems somewhat specious given that librarians are trained to organize information in this manner.

This practice, whatever the reason for it, raises some interesting questions regarding the development of labeling systems for an academic HSL Website. Some institutions have created in-house labels for their catalogs and databases to brand the resources as their own. But in-house brands for such items as MEDLINE or EMBASE further muddy the waters: If there are no subject-oriented guides to the literature and the library named their version of MEDLINE "Leonardo," for example, how would a novice user locate the database? Labeling issues were not addressed by this research and might form the basis for a future study.

The other major category of analyzed links is that of the PNT. A clear and significant majority of academic HSL Websites include persistent navigation. Steve Krug says the following about persistent navigation on a Website:

Done right, persistent navigation should say—preferably in a calm, comforting voice: "The navigation is over here. Some parts will change a little depending on where you are, but it will always be here, and it will always work the same way." [11]

To this end, Krug recommends five elements for every page of a site, in the form of a PNT:

- identification
- a way home
- a way to search
- the Website sections
- utilities

Hammerich and Harrison expand on these premises with a table of navigational elements ranked by priority [12]. This table includes items that are obligatory, high priority, medium priority, low priority, and "nice to consider." Many of these elements, the authors note, are forgotten during the site development process, only to be caught near the end when the site undergoes review.

The development of a similar table, ranking Web elements by priority for both inclusion on the home page and in the PNT, may help uncover best practices for academic HSL Websites. In particular, determining a series of obligatory home page and PNT elements might serve to illuminate best practices for academic HSL Website design.

Of particular note is Krug's first item: identification (ID). Krug summarizes this element as an organization's logo or other form of ID, what marketers often refer to as "brand." While a library logo can be a worthwhile element on every page, so too can another form of identification: an address and telephone number. This element is a common enough—56% of all studied academic HSL Websites include this informa-

Table 5

Best practices: obligatory academic health sciences library Web navigation elements

Home page links	PNT links
<ul style="list-style-type: none"> • Bibliographic databases, listed by title • E-books • E-journals • Hours of operation • Instruction or tutorials • News, events, or "What's New" • Services, descriptions of 	<ul style="list-style-type: none"> • Bibliographic databases, direct link to any specified by name • Contact Web editor or committee • Library OPAC • Library Website feedback form or email link • Library Website search • Link to parent organization
Items were linked by majority of home pages and ratio of PNT links to home page links is <i>less</i> than 50%.	Items were linked by majority of home pages and ratio of PNT links to home page links is <i>greater</i> than 50%.

tion on their home pages (increased to 90% in 2004). In terms of providing both identification and a simple means to contact the library, adding general information such as address, telephone, and fax numbers on every page, as part of a PNT, simply makes sense. Address information ranks as an obligatory element in the table for PNTs, even though it ranks lower than other elements by percentage.

Links back to the home page from successive pages are not included in the analysis of PNTs but are considered absolutely necessary by usability experts such as Krug and Nielsen. In terms of navigation, users should always have a clearly labeled link back to the home page to extract themselves when they have clicked down through several "layers" of the site. A graphical logo or brand may be used as the home page link itself, thus fulfilling the first two of Krug's requirements simultaneously.

Tools or forms for searching library sites are linked from the majority of analyzed PNTs and should be strongly considered for all sites. Similar to the link to a home page, a search tool is important for encouraging users to explore the site. By providing a search tool on every page, users are more likely to adapt easily to the site and locate information they need.

Links for sections of a Website are commonly listed in PNTs. Because every Website is different, these sections vary considerably and are not elements that could easily be included with this analysis. Again, deferring to usability pundits like Krug, users should be able to access any region of the Website from any page, just as easily as they can navigate to the home page.

The final series of elements Krug recommends for the PNT is something he refers to as "utilities." According to Krug's definition, utilities are links to important elements of the site that cannot be considered part of the hierarchy. A utility is any kind of item that cannot be comfortably and easily listed in part of a larger section of the site. With a library Website, this definition expands somewhat. If the Website is designed with a user-centered model, it is not uncommon to have resources that librarians feel should be accessible with a single click from anywhere in the site. Library users also tend to become more advanced as they use the site more frequently or receive training or assistance. Librarians themselves often appreciate "accelerators," a kind of link that gets them to what they need in a single click.

CONCLUSIONS

The findings suggest that many academic HSL Websites have added accelerators to their PNTs. An example is the library catalog—arguably any library's most valued resource—which is accessible through the majority of PNTs. Because so many PNT links, including accelerators, are duplicated on home pages, a formula for determining obligatory links for both becomes apparent.

Obligatory home page links include all items linked by a majority of home pages where the ratio of PNT links to home page links is less than 50%. This ratio would indicate a majority of home pages that include a link not on the PNT. Conversely, obligatory PNT links are calculated as items linked by majority of home pages, with the ratio of PNT links to home page links being greater than 50%. This formula would provide a list of links primarily on the PNT, while allowing that they might also duplicate the links on the home page. The results of this approach are listed in Table 5.

These results, when compared with Krug's five criteria, match in a particularly satisfying way. Links to parent organizations and search forms fall in line with Krug's second and third criteria. Krug's definition of "utilities" could very likely include links to accelerators for bibliographic databases and library OPACs.

By analyzing academic HSL Websites frozen in a moment in time, a selection of obligatory home page and PNT links could be determined. These obligatory links demonstrate a series of best practices that may be followed in the design and construction of academic HSL Websites.

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